

LNG North America

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Accelerating US LNG exports usher in a new global gas order

As exports from the US accelerate, Asia's growing gas import requirements are largely met by LNG on flexible trade terms that usher in a "new global gas order," according to International Energy Agency (IEA). In a buyers' market, three major suppliers – Australia, the USA and Russia – are trying to court price-sensitive buyers across Asia, notably China.

"The oil & gas resurgence of the United States is shaking up the established order, with major implications for markets, trade flows, investment and energy security," IEA analysts stated. The versatility of natural gas means that "it is well placed to grow," analysts suggested but "it cannot afford price spikes."

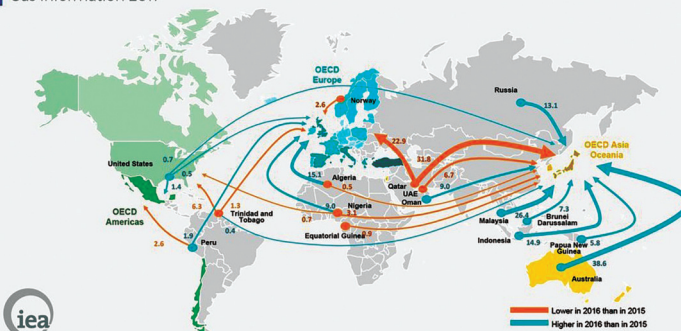
Global gas trade is forecast to expand from 706 Bcm in 2017 to 1,230 Bcm in 2040, with 59% of the volume being shipped in the form of LNG, the IEA said in its latest World Energy Outlook (WEO). For long-distance natural gas trade, meanwhile, LNG is set to account

for almost 90% of the projected growth from now until 2040.

An array of new US LNG export projects is coming to completion over the next few years, raising the stakes and intensifying competition with rival projects not only in Australia but also in Russia. By 2021, four LNG export facilities currently under construction are expected to be completed:

- Dominion Energy's Cove Point LNG in Maryland has started production from Train-1 as of January 31. The facility's full nameplate capacity of 5.25 mtpa is expected to enter

Map of LNG movements in the OECD (Bcm)*
Gas Information 2017



commercial service in March.

- Corpus Christi LNG, another Cheniere project located in Texas with up to 2.14 Bcf/d permitted capacity, is slated to start service in late 2018, or early 2019.
- Sempra Energy's Cameron LNG terminal in Louisiana has 1.7 Bcf/d permitted capacity, with three trains due to online in 2018.

- Freeport LNG in Texas has three trains under construction totalling 1.8 Bcf/d. The first two are scheduled to begin service in 2019, and the third in 2020.

"With destination flexibility, hub-based pricing and spot availability, US LNG acts as a catalyst for many of the anticipated changes in the wider gas market," IEA analyst commented, adding that "price

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Tanker with Russian LNG diverted to Boston

Defying fresh sanctions by the Trump administration, a Gaselys tanker carrying the first LNG exported by the Yamal facility in the Russian Arctic, has berthed at the Engie SA Everett import terminal in Boston on January 28. This marks the first time that natural gas from Russia reaches the United States.

The US Treasury had issued sanctions against Russian energy companies in July 2014, in response to Russia's annexation of Crimea. These sanctions prevent any US financing for Russian oil and gas projects but they do not prohibit the purchase of natural gas originating from Yamal.

A cold snap in New England, combined with a shortage of pipeline capacity to transport domestic US shale gas from Pennsylvania towards the greater Boston area, propelled up prices high enough to create an appetite for importing spot LNG. When a winter storm brought down a large nuclear plant in early January, there was not enough gas supply available to allow gas-fuelled power stations generate baseload power supply, so utilities had to resort to burning fuel



Gaselys LNG tanker at Engie's Mystic River regas facility

oil instead. The ISO New England grid operator warned that managing the regional power system "continues to be challenging."

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formation is based increasingly on competition between various sources of gas, rather than indexation to oil.

Russia, meanwhile, is adamant about boosting production at Sakhalin LNG, targeting the Asian markets. "The top priority for our eastern export corridor is production of LNG, which will be consumed by the Asia Pacific countries," Gazprom's chief executive officer Alexei Miller said, forecasting Asia's gas consumption will increase by 80% by 2030. Gazprom, the former Russian gas export monopoly, now faces a tight rivalry from a home-grown player - Russia's privately owned gas producer Novatek whose 5.5 mtpa Yamal LNG project began exporting last month.

China turns into LNG sink

Emerging economies in Asia increasingly turn to flexible LNG supplies to cover their gas demand. "New buyers, often smaller scale, are appearing. According to figures in the latest World Energy Outlook (WEO), the number of LNG-importing countries has risen from 15 in 2005 to 40 today, many of which are small-scale importers in Southeast Asia and Africa.

The elephant in the room is China. "When China changes, everything changes," IEA analysts said, suggesting the Asian nation was entering a new phase in its development, with the emphasis in energy policy now firmly on electricity, natural gas and cleaner, high-efficiency and digital tech-

nologies. To that end, the Chinese President Xi Jinping has ushered in an "energy revolution" in the "fight against pollution" and the transition towards a more services-based economic model is moving the energy sector in a new direction.

"The scale of China's clean energy deployment, technology exports and outward investment makes it a key determinant of momentum behind the low-carbon transition. China provides a quarter of the projected rise in global gas demand and its projected imports of 280 billion cubic metres in 2040 are second only to those of the European Union, making China a lynchpin of global gas trade," the IEA said.

LNG will cover most of China's marginal demand growth, and the

IEA said that with few exceptions - most notably the route that opens up between Russia and China - major new pipelines will struggle in a world that "prizes the optionality" of LNG.

In 2108, Energy Aspects expects Chinese gas demand to grow by 12%, or 27 Bcm, while domestic supply is set to expand by 12-15 Bcm/y. To fill the gap, pipeline gas imports will likely increase by an average 5 Bcm/y while LNG import rise by around 10 Bcm, equaling 8 million tons. These levels of demand and LNG are likely to persist through 2020, Energy Aspects forecast.

"So, for now the global LNG market is likely able to rely on strong Chinese import growth, albeit not at 2017 rates." ■

NYMEX gas futures trade at a discount to Henry Hub spot price

The February 2018 futures contract for natural gas on the New York Mercantile Exchange (NYMEX) is trading at a discount to the current spot price. This pricing pattern provides economic incentives to withdraw natural gas from storage to avoid exposure to the spot market.

The average natural gas spot price at the Henry Hub was \$4.09/MMBtu, 90 cents higher than the front-month futures price at the NYMEX. A year ago, the spot price was 7¢/MMBtu lower than the front-month contract, according to the latest weekly gas update from the US Energy Information Administration (EIA).

High natural gas withdrawals have caused a working gas deficit of 124 Bcf compared with the five-year average, adding to the bullish momentum for NYMEX gas futures. Net withdrawals from storage totaled 288 Bcf for the week ending January 19, com-

pared with the five-year (2013-17) average net withdrawal of just 164 Bcf. Total working gas stocks stand at 2,296 Bcf - some 486 Bcf less than the five-year average and 519 Bcf less than last year at this time.

Storage withdrawals are near the upper end of analysts' expectations and prices for Nymex February gas futures consequently rose about 4¢/MMBtu, averaging \$3.50/MMBtu. Prices for the March contract gained about 1¢/MMBtu, averaging \$3.12/MMBtu, with 836 contracts traded at the release.

Spot prices, meanwhile, fell at most locations this report week

Spot Prices (\$/MMBtu)	Thu, 18-Jan	Fri, 19-Jan	Mon, 22-Jan	Tue, 23-Jan	Wed, 24-Jan
Henry Hub	3.38	3.18	3.13	3.36	3.56
New York	4.45	3.40	3.13	3.71	5.12
Chicago	3.01	2.93	2.91	3.09	3.27
Cal. Comp. Avg.*	2.83	2.80	2.84	2.89	2.98
Futures (\$/MMBtu)					
January Contract	3.189	3.185	3.224	3.444	3.509
February Contract	2.988	2.941	2.931	3.039	3.080

*Avg. of NGI's reported prices for: Malin, PG&E Citygate, and Southern California Border Avg.

Source: NGI's Daily Gas Price Index

ending January 24. The Henry Hub spot price fell from \$3.87 per million British thermal units (MMBtu) last Wednesday to \$3.56/MMBtu yesterday.

Mild weather keeps short term gas demand subdued, and temperatures are forecast to increase further, adding bearish momentum to key US pricing points. ■

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Gas destined for Mystic Power Generation plant

The Gaselys tanker that now brought some relief to gas customers near Boston did not come directly from Yamal, but was sourced through a chain of companies having been diverted on route through several locations. The LNG tanker itself is owned by Engie of France which has regasification terminals in the Mystic River. Once fully unloaded, the regasified natural gas will be delivered to the Mystic Power Generation plant in Massachusetts and other local utilities, an Engie spokeswoman said.

Changing hands multiple times before arriving at Boston, the cargo from Yamal LNG was picked up by

Gaselys some three weeks ago at a storage terminal at the Isle of Grain, UK. National Grid, the owner of the Grain LNG regas facility had been seeking to re-export the Russian LNG, stressing it was not meant to be used in Britain.

The LNG from Yamal had been delivered to Britain onboard the tanker 'Christophe de Margerie', named after the former CEO of Total, the French company that owns a 20% stake in the Yamal project. When leaving the Grain terminal the LNG cargo had changed hands another time, having been sold to Petronas LNG UK. This multiple re-sale of the cargo clouds the course of its track and blurs the lines with US treasury sanctions. ■

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Mexico to launch online gas trading platform by mid-2018

Mexico, the largest offtaker of US pipeline gas and LNG importer from Peru, Nigeria and the US, is getting ready to launch an online gas trading platform by the summer of this year, at the latest. The Federal Electricity Commission (CFE), Mexico's state-owned grid operator, also plans to set up several gas pricing points. "We'll have Henry Hub, too, as that's what we now have," said Javier Gutierrez Becerril, director of operations at CFE Energy.

"Before the end of the next quarter, we hope to have the online service operating, which we have been working on for a year," Becerril disclosed in a speech. Details are being finalized, he said, adding the online trading platform will include day-ahead pricing and monthly indexes available in other markets.

"We envisage a combination of everything and we will do it in a conventional ways, flows-of-the-month and daily intra-day data. We're not trying to re-invent the wheel," Becerril stressed. Hubs for natural gas trading are envisaged to include Hermosillo, Encino and La Laguna, all areas where several pipelines inter-connect, but the exact locations are still subject to approval.

An efficient power generation market needs to be underpinned by reliable natural gas pipeline transportation capacity, Becerril argued, hence CFE is fostering a closer cooperation with Mexico's Natural Gas Control Centre (Cenagas).

Aspiring for a 'Mexican Henry Hub'

In the long-run CFE Energy is aspiring to establish a major gas trading benchmark, similar to the one in the United States. "We'll have Henry Hub, too, as that's what we now have," Becerril suggested. His goal may well seem far-fetched - considering the daily trading volume record for Henry Hub Natural Gas futures on

New U.S.-Mexico natural gas pipelines



January 12, 2018, surpassed the 1 million milestone - but he remains adamant about giving it a try.

With the new Mexican trading hubs, CFE Energy seeks cover "both sides of the Mexican-US border, Becerril maintained, although the actual online platform would concentrate mainly on the Mexican market.

Mexico's Energy Regulatory Commission (CRE) already publishes a National Reference Index for Natural Gas Wholesale Prices once a month as an indicator.

Four US-Mexico pipelines under construction

Exports of cheap US shale to Mexico are set to accelerate with the imminent start of four pipeline interconnectors, currently under construction: Roadrunner (Phase II), Comanche Trail, Presidio Crossing, and Nueve Era, with a total capacity of 3.5 Bcf/d. These four pipelines will supply gas to new power plants in the Mexican states of Chihuahua, Nuevo Leon, Sonora, and Sinaloa.

By the end of 2018, two additional pipelines - KM Mier-Monter-

rey and Neuces-Brownsville, with 3.3 Bcf/d capacity, are scheduled to start exporting US gas to Mexico's Northeast and Central regions, mainly from the Eagle Ford play in southern Texas.

In the first week of December 2017, US gas export to Mexico - both by pipeline and shipments of LNG cargoes - have reached an all-time high of just under 7.8 Bcf/d this week, following record high Lower 48 gas production at around 77 Bcf/d at the start of the week.

"This current picture sets up badly for the bull balance argument in 2018, especially given most of the LNG demand increases won't come online until the end of 2018 and 2019," analysts at HFI Research commented. "If producers do meet all the takeaway capacity that comes online in Q1-2018, then prices will have to move lower over the injection season (April to November) to accommodate for higher power-burn demand."

In terms of LNG imports, Mexico can currently land LNG cargoes at its Altamira facility in the Gulf of Mexico, at Manzanillo on the Pacific Coast and at Costa Azul, north of the Pacific port of Ensenada.

Forecasts fuel NYMEX

US natural gas futures on the New York Mercantile Exchange continued to soar because of forecasts of high natural gas withdrawals in the next storage report on January 25 from the US Energy Information Administration as well as the expected return of cold weather to the East Coast. The NYMEX front-month contract was last at \$3.48 per million British thermal units while the US Henry Hub benchmark spot price was at \$3.33 per MMBtu. European prices were little changed from seasonal averages, with the UK National Balancing Point price being at the equivalent of \$6.80 per MMBtu and the Dutch Title Transfer Facility (TTF) price quoted at \$6.50 per MMBtu. Energy prices were underpinned by the North Sea Brent crude oil price hitting \$71 per barrel.

US gas prices stay high

US natural gas futures on the New York Mercantile Exchange soared because of high natural gas withdrawals in the latest storage report as US West Texas Intermediate crude prices hit a 12-month high and North Sea Brent oil stayed above the \$70 per barrel mark. The NYMEX front-month futures price was last at \$3.43 per million British thermal units while spot prices followed futures higher to be quoted at \$3.59 at the Henry Hub because of forecast colder weather heading for the US in February.

“In the long-run CFE Energy is aspiring to establish a major gas trading benchmark, similar to the one in the United States.”

US gas production, exports to rise through to 2019

Spurred by rising gas demand from the electric power sector, industry and LNG exporters, US dry natural gas production is forecast to rise by an average of 80.4 billion cubic feet per day (Bcf/d) in 2018, up 6.9 Bcf/d or 9.3% on the 2017 level which would be the highest increase on record, according to figures by the Energy Information Administration (EIA). A more moderate 3.2% rise of 2.6 Bcf/d is expected for 2019.

"The strongest growth in dry natural gas production occurred late in the year, as improved economics related to expanded pipeline capacity contributed to a 3.8 percent increase in production between the third and fourth quarters of 2017."

"The rate of production growth is expected to moderate in 2018," said the US Energy Information Administration (EIA) said in its latest Short Term Energy Report (STEO).

If achieved, the forecast 6.9 Bcf/d increase in 2018 would be the highest on record. Growth is expected to be concentrated in Appalachia's Marcellus and Utica regions, along with the Permian Basin region.

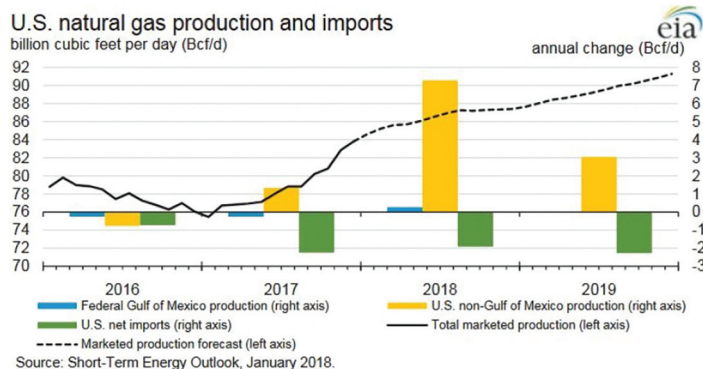
"Much of the expected increase in natural gas production is the result of rising pipeline take-away capacity out of the Appalachia producing region to end-use markets," the EIA stated, explaining "The greater pipeline connectivity contributes to higher wellhead natural gas prices for producers and is expected to encourage production growth."

The surge in gas supplies has a bearish impact on prices. Mar-

keted natural gas production is forecast to rise to 86.44 billion cubic feet per day in 2018 from 78.88 Bcf/d last year and to 89.46 Bcf/d in 2019.

On the price front, Henry Hub natural gas spot prices are forecast to average \$2.88 per million British thermal units (MMBtu) in 2018 and \$2.92/MMBtu in 2019, compared with the 2017 average of \$2.99/MMBtu. By December 2018, the EIA expects Henry Hub spot prices to hover around the \$3.04/MMBtu price level, which is says "should be considered in the context of NYMEX contract values for December 2018 delivery."

Low gas prices will further increase gas-burn in US power stations. EIA expects the share of U.S. total utility-scale electricity generation from natural gas to rise from 32% in 2017 to 33% in 2018 and to 34% in 2019. Coal's forecast generation share, meanwhile is forecast to falls from 30% in 2017 to slightly lower than 30% in 2018 and 28% in 2019. The nuclear share of generation was 20% in 2017 and is forecast to average 20% in 2018 and 19% in 2019.



LNG exports are seen average 3.0 Bcf/d in 2018, up from 1.9 Bcf/d in the past year. "In 2018, US liquefaction capacity will continue to expand," the EIA said.

Analysts at the agency expect the Cove Point terminal in Maryland to ramp up to full capacity. At the Elba Island facility in Georgia, six of the 10 small modular trains, each with a capacity of 0.03 Bcf/d, are expected to enter service. The first liquefaction train (capacity 0.7 Bcf/d) at Freeport LNG in Texas is also expected to come online by the end of 2018," the STEO report reads.

By the end of 2019, the forecasts that gross LNG exports will average 4.8 Bcf/d, providing the

four remaining modular trains at Elba Island come online and the remaining two trains at Freeport LNG enter service. "In both 2018 and 2019 the new liquefaction facilities will require a ramp up period, and they are forecast to operate below nameplate capacity for a period of time, lowering the overall LNG export capacity utilization rate," stated the EIA.

As for exports to Mexico, the EIA noted increased pipeline capacity in both the United States and Mexico have led to increased exports. "US gross pipeline exports are expected to increase by 0.6 Bcf/d in 2018 and by 0.8 Bcf/d in 2019 to an average of 8.0 Bcf/d."

South America: Conflicting agendas over future role of LNG

Conflicting agendas add to the confusion on the future role of LNG in South America, and even the direction of LNG trades", given that three countries – Argentina, Brazil and Chile – were importing LNG while "in parallel, some countries harbour future ambitions to join Peru as LNG exporters when (or if) their national production permits."

Overall, the OIES forecasts annual gas demand across South America will grow by some 50 billion cubic meters (Bcm) to reach 191 Bcm by 2030. But under one extreme scenario, the Oxford Institute for Energy Studies (OIES) report anticipates the South America region to import as little as 7 Bcm/year of LNG in 2020 "under 'normal' weather conditions with Bolivian export commitments fulfilled and contracts prolonged."

At any event, Brazil, Argentina and Chile will continue to import

LNG and will be joined by Uruguay and Colombia, the OIES forecasts, with Peru likely to remain the only exporter. Peru's LNG export facility at Pampa Melchorita started operations in June 2010. The 4.45 million tons per year gas liquefaction plant is located 170 kilometers south of Lima and receives gas via a 408-kilometer pipeline built across the Andes.

Plans for a region-wide integration of gas pipelines are unlikely to materialize, researchers say,

"but there is a possibility of sub-regional integration around LNG import terminals, as suggested by projects in Uruguay, Colombia or even LNG arriving in Chile and being sold to Argentina."

Uncertainly about Bolivian supplies

By 2030, there is potential for 19.5 Bcm/year of LNG imports to South America "under 'normal' weather conditions and if Bolivia's renew both its pipeline export contracts at levels allowing Ar-

gentina and Brazil to balance their demand" the reports explains.

LNG imports could rise to 30.5 bcma (22.4 mtpa) "in the case of no Bolivian exports, still under 'normal' weather conditions," OIES forecasts.

Cold winters and dry weather have the potential to propel up demand which can have a significant impacts on LNG intake. In Brazil alone, it could add up to 35 Bcm/year (25.7 mtpa) of LNG imports (on top of already needed imports) on a dry year by 2030. ■

Coal demand to stay flat till 2022 in “decade of stagnation”, IEA says

Global coal demand is facing a “decade of stagnation” and should remain nearly flat between 2017 and 2022, the International Energy Agency (IEA) forecasts. Lower gas prices, a surge in renewables and improvements in energy efficiency have caused a 1.9% fall in global coal consumption last year to 5,357 million tonnes of coal equivalent (Mtce) - the second year of decline.

In its annual coal report, released this week, the IEA forecast the share of coal in the global energy mix will fall from currently 27% to 26% in 2022 “because of sluggish demand compared with other fuels,” analysts said. Although coal-fired power generation increases by 1.2% per year through 2016-22, its share of the power mix is anticipated to just below 36% by 2022.

Coal demand has dropped 4.2% over the last two years, nearly matching the two-year decline in the early 1990s, which remains the biggest drop on records. By 2022, global coal demand is expected to reach 5,530 Mtce, the same as the average of the last five-year period, meaning demand has stagnated.

“The energy system is evolving at a rapid pace all around us, with a more diversifying fuel mix, and the cost of technologies going down,” commented Keisuke Sadamori, the IEA’s director for energy markets and security. “But while everything else is changing,

global coal demand remains the same.”

No sign of demand slow-down in India

In China, the US and the European Union, coal demand decreased last year but it has risen in India, and across many parts of Southeast Asia where it shows no signs of slowing down. For instance, despite the rapid growth in renewables, Indian coal-fired power generation is expected to grow almost 4% a year through 2022.

Though India will become increasingly important to global coal markets, China will remain the key driver. The potential for coal demand growth in China is limited, but the country’s supply-side reforms will be critical factors for coal prices in the coming years.

The European Union, accounting for just 6% of global demand

today, is forecast to become “an increasingly marginal player.”

In technology terms, the IEA said urgent action was needed to support Carbon Capture, Utilisation and Storage (CCUS) technologies, which still lags far behind other low-carbon technologies. Mr Sadamori called on governments and companies to step up their policy support and investments in that sector in

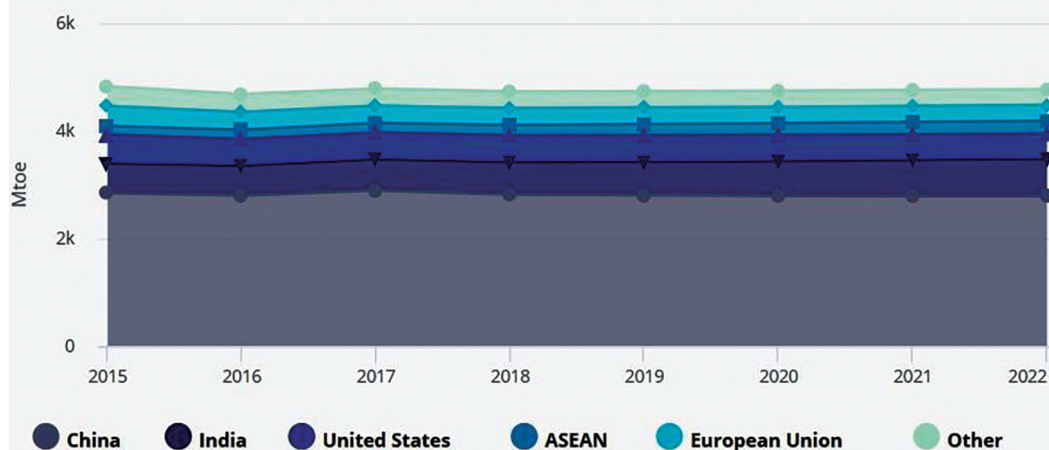
order to meet global climate goals.

“Indeed, without CCUS, coal use will be seriously constrained in the future,” he underlined. ■



Coal Demand Forecast 2016-22

Click a region in the legend to hide/show on the chart



Source: Market Series Report: Coal 2017

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LNG cargoes for China

The 172,000 cubic metres capacity “Beidou Star” is scheduled to deliver a cargo on January 27 to the Chinese Dalian import terminal, owned by PetroChina, from the Gorgon LNG plant on Barrow Island in Western Australia. The 174,000 cubic metres capacity “Gaslog Glasgow” will deliver a shipment on January 29 to the Chinese Tianjin North import terminal, owned by Sinopec, from the Australia Pacific LNG plant in Queensland, operated by ConocoPhillips. The 155,000 cubic metres capacity “Gaslog Sydney” is heading for South America’s only LNG export plant at Pampa Melchorita in Peru to lift a cargo on January 29 for Asia.

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Monetizing cold heat at LNG regas terminals

LNG tanker transport natural gas liquefied at -161°C which is subsequently supplied to an import terminal where the LNG gets regasified by using heat exchangers (ambient and combustion vaporisers). During this regas process much cold energy gets set free which can be utilised, and monetized, shows an analysis from *Ranjan Saxena and Rohit Nayek, Department of Oil and Gas, University of Petroleum and Energy Studies, Dehradun, India.*

The global designed capacity of LNG import terminals is 795 mtpa, with importing facilities having grown at a rate of about 3% growth in recent years. Utilisation of import and regas terminals vary greatly: From Taiwan's 100% overall utilization, and the drive to expand the country's regas capacity from 13 mtpa to 16 mtpa by the end of this year, down to just 1% utilization of import capacity in the United States, where in fact some regas terminals are being converted into liquefaction and export terminals.

Applications of Cold Energy

LNG Import terminals are constantly under pressure to operate at higher efficiencies and cut down on operation cost. Thus, the LNG import terminals can capitalize on the availability of cold energy and new sources for generating revenues. The various applications of cold energy are- space cooling, desalination, elastomer crushing, power generation, Inlet

Air cooling for turbines and production of gases by cryogenic air separation.

Water Desalination (Cryo-Desalination)

Principle - Water desalination takes place naturally at polar icecaps, due to the fact that ice crystals are formed of pure water at certain sub-zero temperature range which separates the impurities from water. This freezing method utilises phase change of water from liquid to solid state. Theoretically, to freeze 1 kg of water 80kcal of energy is required while to evaporate 1 kg of water 600kcal of energy is required.

Process - The process of cryogenic desalination involves three steps- freezing, washing and melting. In case of LNG Import Terminal; LNG can be utilised as refrigerant to freeze pure water. After freezing, the ice and brine solution is transferred to a washer with the help of gravity. The

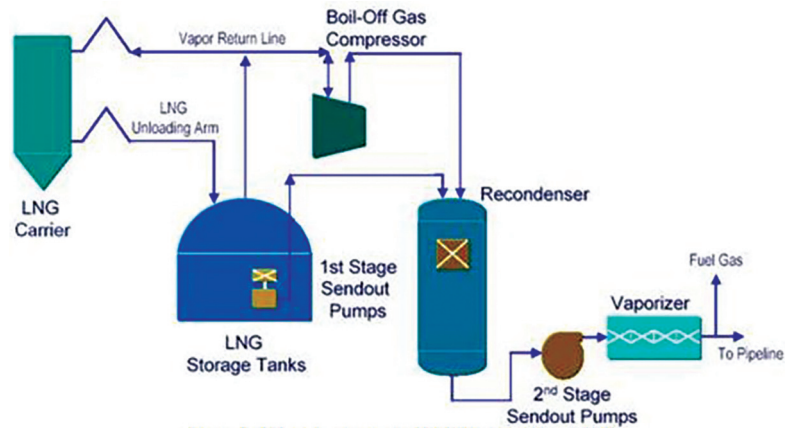


Figure 1: Process Layout of LNG Import Terminal

washer removes the brine by using fresh water. The ice is then transferred to Melter where it is melted at ambient temperature or by utilising the waste heat available in the plant. A small portion of fresh water is recirculated to the washer which is used to wash the pure water ice crystals. To enhance the efficiency of the process the saline feed water is cooled using heat exchanger by employing the cold brine solution and cold fresh water.

Benefits -

- It reduces the problems like scale formation, fouling and corrosion, this provides the ease of material selection and process layout.
- This process is insensitive to the changes in the concentration or the type of substances in the sea water.
- This process is also suitable for Industrial and/or waste water which cannot be desalted by membrane process.

Applicability of Cryo-Desalination

China is projected to have water deficit of 201 billion cubic metre by 2030. The country has an increasing problem of pollution and has polluted many of the existing fresh water resources. It has designed capacity of 49 mtpa of LNG Import and currently utilises 56%

of it. At current utilisation rate it has a potential of about 600 MW. Out of which 150 MW is usable looking at the global scenario of cold energy utilisation. This 150 MW is sufficient to produce approximately 1600 kg of water per hour. This is enough to suffice potable water demand of a community of 10,000 people (considering 3 liter water consumption per person).

Taiwan has the highest utilisation rate of 118%. It can utilise the cold energy to suffice the potable water demand of 5000 people. Its higher utilisation gives it an added advantage.

Egypt currently has a water deficit of 7 billion cubic metre. It is projected that by the year 2025 it will run out of water. It is also predicted that Egypt will have spurt population growth till 2025. At current capacity and utilisation rate it can provide potable water for 3000 people.

Conclusion

In this era of scarce resources, it is important to harness all sources of energy. Cold Energy utilization is a step towards higher energy recovery but not all available applications of cold energy is feasible for every location, the authors said, stressing the importance of carefully evaluating possible avenues and solutions.

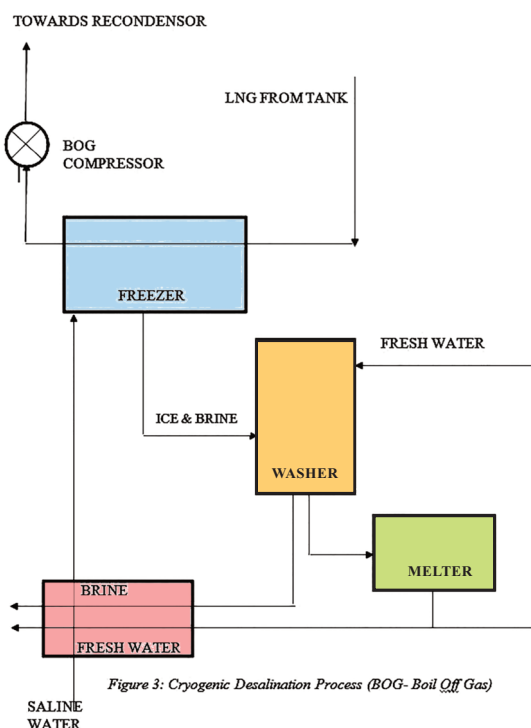


Figure 3: Cryogenic Desalination Process (BOG - Boil Off Gas)

Cryogenic Desalination Process (BOG - Boil Off Gas)

At the Core of LNG

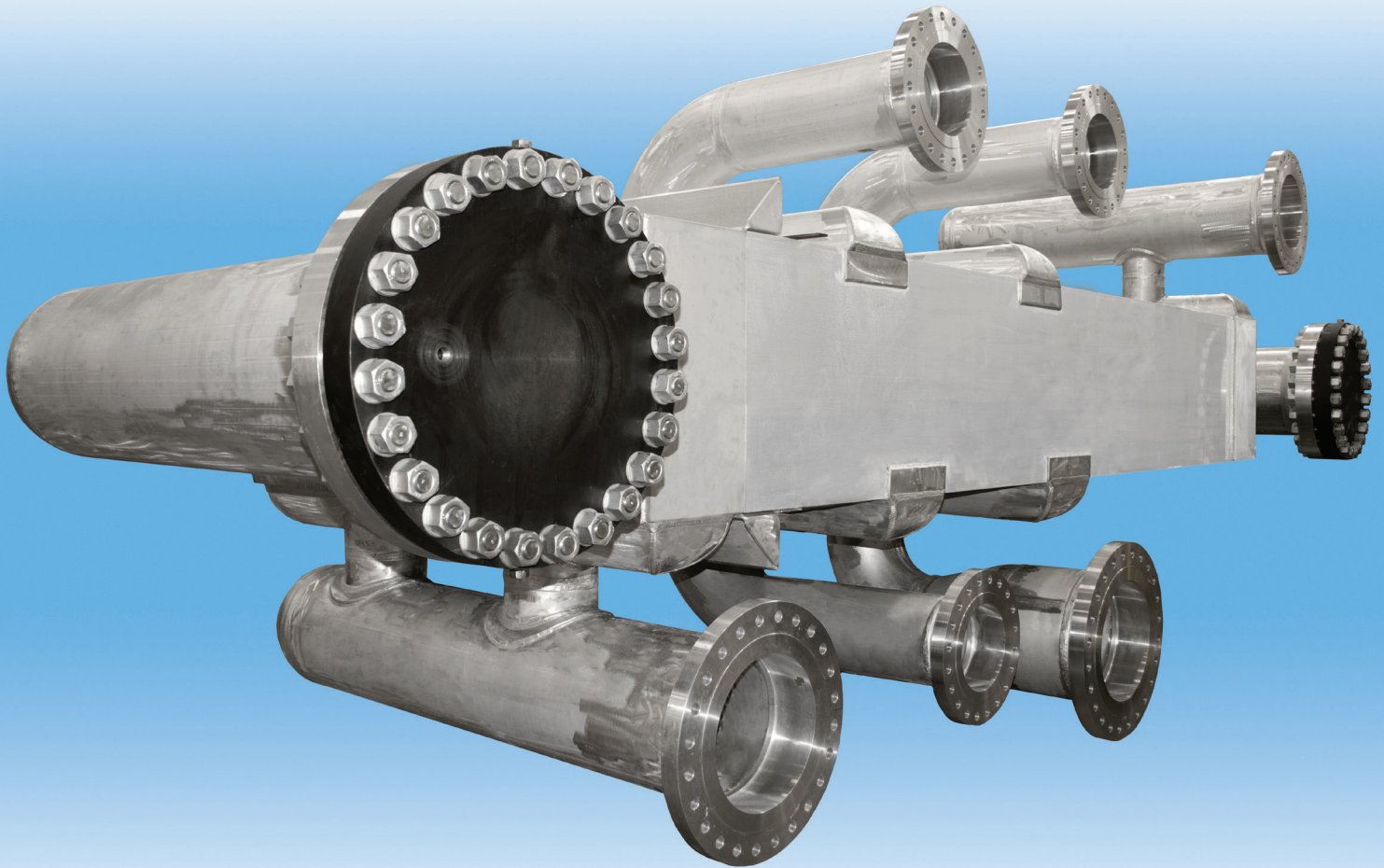


Chart brazed aluminum plate fin heat exchangers (BAHX) are highly efficient, custom engineered, compact units that have been at the heart of LNG liquefaction processes since the 1970's and are facilitating the export of North American shale gas today.

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First train of Corpus Christi LNG to be completed by March 2019

Cheniere Energy has told regulators that Train-1 of its Corpus Christi LNG export project in Texas will reach substantial completion in March 2019, followed by completion of Train-2 in September 2019.

The latest Corpus Christi progress report was filed to the Federal Energy Regulatory Commission (FERC) under the name of Cheniere's subsidiary Corpus Christi Liquefaction. The Texas liquefaction plant is being built on the shore of Corpus Christi Bay, at the north end of the La Quinta Channel. The report covers construction activity through December 2017 and the Corpus Christi facility's building activities for January 2018 were said to be on track.

US engineering company Bechtel has been leading the construction at Corpus Christi as well as at Sabine Pass and will construct all three Trains currently planned at the Texas facility. At Sabine Pass, Cheniere already brought four

Trains on stream with 18 million tonnes per annum of output and two more to complete.

The Phase 1 engineering procurement and construction contract for Corpus Christi includes building two LNG Trains, each with 4.5 million tonnes per annum of capacity, two storage tanks, one complete berth and a second partial berth.

The contract for Phase 2 includes one LNG Train, one additional tank, and completion of the second berth. The total capacity will be 13.5 MTPA.

The Texas plant's current cargo sales agreements amount to more than 9 MTPA, or two whole Trains of production.

Foundation customers include



Indonesian energy company Pertamina, Australian LNG producer Woodside and the European-based utilities Endesa, Iberdrola, Gas Natural Fenosa and Electricite de France.

"Stage 1 construction continued progressing permanent plant concrete, structural steel, above-ground pipe, electrical, instruments, insulation, equipment installation, East Jetty activities and LNG Tank A and C activities," said the report.

It noted major highlights for

last month's building work included setting Train 2 filter houses and air coolers, the commencement of riser erection on Flare Derrick structure, the energization of the Operations & Maintenance-Control Room building and progress on Train 1 LNG compressor substation.

The venture has potential pipeline supply points on five pipelines, namely Natural Gas Pipeline Company of America, Tennessee Gas, Houston Pipe Line, Kinder Morgan Texas and Transco.

Siemens consortium to build 1.3-GW LNG-to-Power plant in Brazil

Prumo Logística has said that its subsidiary, Gás Natural Açú (GNA), has hired a consortium formed by Siemens and Andrade Gutierrez to build a 1,238-MW thermal power plant, based on imported LNG, in the Port of Açú in the Brazilian state of Rio de Janeiro. Construction is expected to start in Q1-2018.

The deal was concluded after the Brazilian Electric Energy Agency (Aneel) authorized the transfer of the Novo Tempo power plant to UTE GNA I, a company affiliated with GNA.

Siemens and Andrade Gutierrez will be responsible for engineering solutions, supplies, and construc-

tion of the power plant, which will have an installed capacity close to 1.3 GW.

"Installing the thermoelectric power plant is part of Açú Gas Hub, a project under development in the Port of Açú Complex to provide a logistics solution for the reception, processing, consumption

and transportation of natural gas from Campos and Santos Basins, as well as import and storage of imported LNG," Prumo said in a statement.

Capacity contract backs Acu-3 unit

In December, Prumo was successful in an energy auction for the 1,672-MW Acu-3 power unit which means that about 43% of the overall installed capacity at the Acu project has been contracted in the auction.

Prumo reportedly sold the power for 213.91 Rials per MWh, a 33% discount on the ceiling price of R319/MWh established by the Brazilian government for gas fired power projects. Acu-3 is slated to start commercial operation in January 2023, backed by a 25-year power purchase agreement.

Plans for LNG hub in Port of Acu

Initially, the LNG-to-power project was not meant to be developed in the Port of Acu in the Rio de Janeiro state but in Brazil's north-eastern Pernambuco state. However, Prumo transferred the project location after it took over the-called Novo Tempo gas power project from the Bolognesi Group in summer last year, seeking to set up an LNG hub in the Port of Acu.

In a notice sent to the Brazilian stock exchange in June 2017, Prumo informed it had signed a contract with UTE Novo Tempo for the transfer of the authorization for construction and operation of a 1,238-MW thermal power plant. In addition, Prumo also took over related energy trading agreements that Novo Tempo had entered with power distribution companies.



Açu Port, source: Prumo Logística

ExxonMobil joins initiative of European IOCs to curb methane emissions

The US oil major ExxonMobil has joined a group of eight International Oil Companies (IOCs), led by the European majors Shell and BP, to jointly put forward proposals to curb methane emissions from upstream operations, notably shale gas fracking. For Exxon, this is the first time the company joins an environmental initiative alongside industry peers.

Other European IOCs participating in the initiative are Italy's Eni, Spain's Repsol, Norway's Statoil, Total of France and Wintershall of Germany. In a joint statement, the companies said they are "committed to further reduce methane emissions from the natural gas assets."

The eight companies signed a "Guiding Principles" document, which focuses on: continually reducing methane emissions; advancing strong performance across gas value chains; improving accuracy of methane emissions data; advocating sound policies and regulations on methane emissions; and increasing transparency.

"The commitment was made as part of wider efforts by the global energy industry to ensure that natural gas continues to play a critical role in helping meet future energy demand while addressing climate change," the companies said.

Methane, more polluting than CO2

Methane - the primary component of natural gas - is a much more potent greenhouse gas than CO₂; and methane emissions surged over the past 15 years as the global shale gas boom unfolded. According to Shell, around 10% of the natural gas that gets transformed into LNG tends to get released into the atmosphere between production at well-head and consumption in downstream markets.

While energy-related carbon emissions get released when fossil fuels are burnt, methane can also escape in the atmosphere during the shale gas fracking process, or from leaky pipelines. The upstream oil and gas sector, as well as coal mining, are the largest source of methane emissions in the United States, according to the US Energy Department.

Around 76 million tons of methane is emitted every year



Gas flaring at an US shale gas fracking site

from global oil and gas operations - the equivalent of more than Australia's entire natural gas output, Fatih Birol, executive director of the International Energy Agency (IEA) told an industry gathering last month.

Exxon's new green credentials

In 2016, ten companies set up the Oil and Gas Climate Initiative (OGCI) which grew to now represent over 20% of the world's hydrocarbon production. Exxon did

not join that initiative at the time.

Yet, pressure from investors and legal challenges seem to have led to a change of mind. In recent months, Exxon has increased its climate-related disclosures in earning reports, pledged alliance to the Paris climate agreement and stepped up efforts to reduce emissions at its upstream and mid-stream processes - but the US oil major still refused to comment on queries how climate change may affect its operations. ■

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